

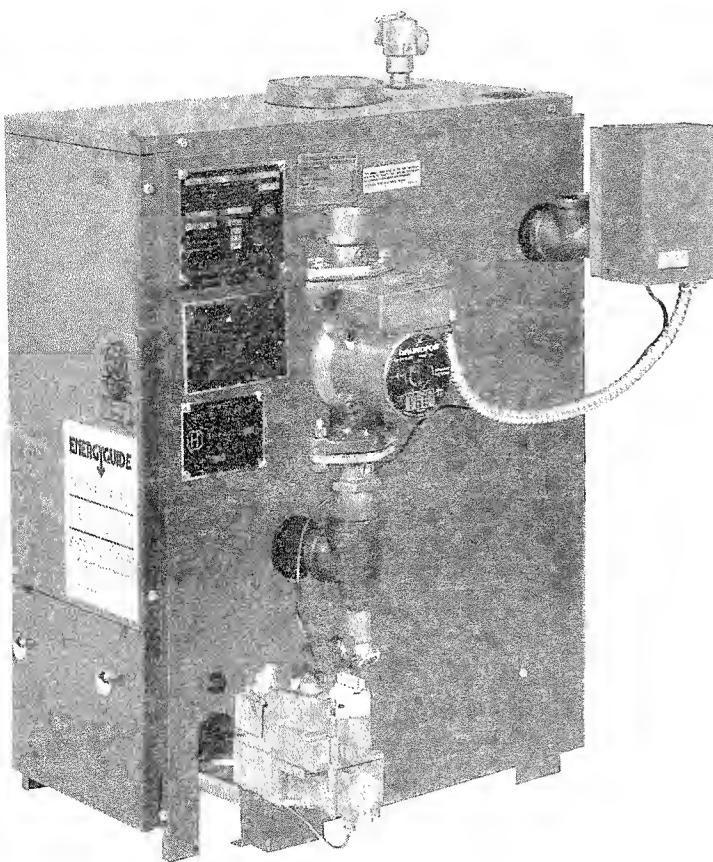
GAS-FIRED HOT WATER BOILERS

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler.



WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier. Natural gas boilers are not to be converted to LP Gas.



These Gas-Fired Hot Water Boilers are low pressure, sectional cast iron boilers Design Certified by A.G.A. (American Gas Association) for use with Natural and Propane Gases. They are constructed and hydrostatically tested for a maximum working pressure of 50 psi (pounds per square inch) in accordance with A.S.M.E. (American Society of Mechanical Engineers) Code IV Standards for cast iron boilers.

LOCATING THE BOILER

1. Select level location as centralized with piping system, and as near chimney, as possible.
2. Place crated boiler at section location, remove crate by pulling crate sides from top and bottom boards. Combustible floors: When boiler is to be installed on a combustible floor, a Special Base Plate must be used - 42135.
3. Boiler is to be level. Metal shims may be used under base legs for final leveling.
4. **Accessibility clearances must take precedence over fire protection clearances.**
18" clearance must be maintained at a side where passage is required to access to another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Boilers must be installed at least 6" from combustible material on all sides. Allow at least 24" front and right side for servicing.
The room must have a total cubic foot volume not less than 16 times that of the boiler.
5. When unit is installed in a relatively air tight room or building, outdoor air must be provided for ventilation, combustion and draft hood dilution. Provide two openings of equal area; one above draft diverter relief opening, one near floor. Minimum free area of each opening must be one square inch per 1000 BTU/hr. boiler input, in no cases less than 100 square inches.
Openings to outdoors must have minimum free area of 1 square inch per 4000 BTU/hr. of input rating, through grilles, 1 square inch per 2000 BTU/hr. of input rating through duct work.
6. Advise owner to keep air passages free of obstructions. Ventilating and combustion air must enter boiler room without restrictions.
7. The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1-1988.

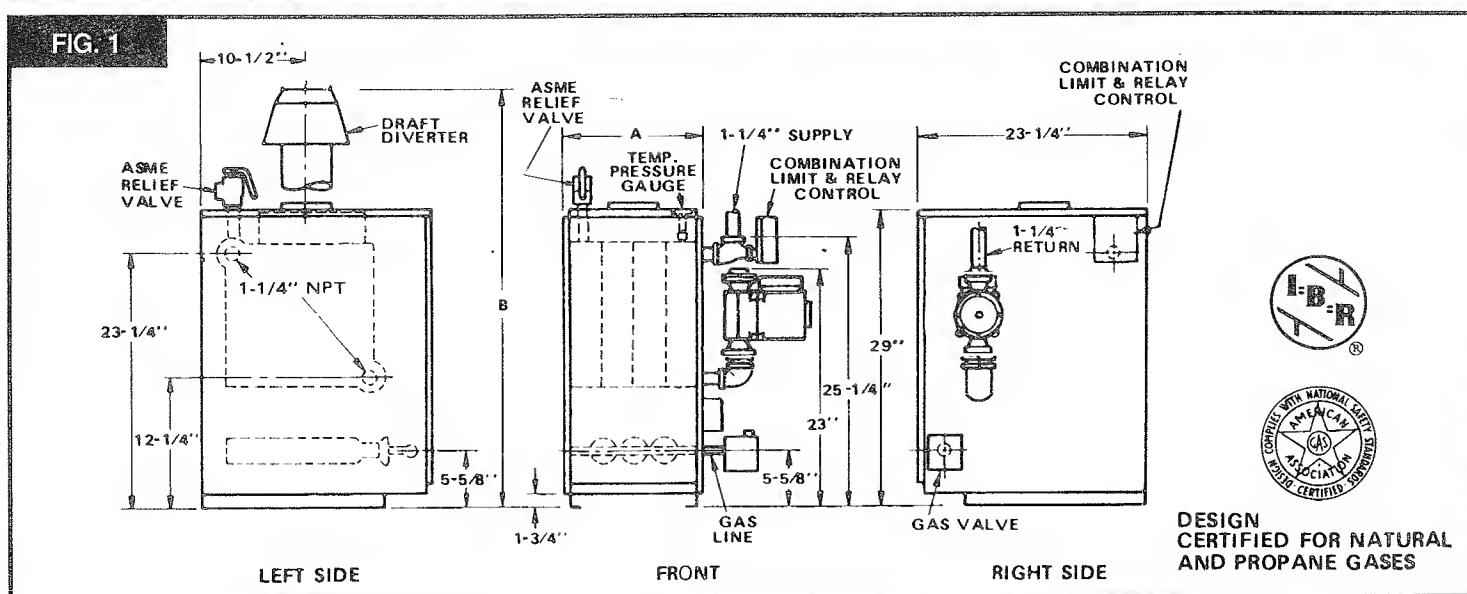


CROWN INDUSTRIES, INC.

2101 East Allegheny Avenue • Philadelphia, Pa. 19134

Boiler Ratings and Capacities

FIG. 1



GAS-FIRED HOT WATER BOILERS

MODEL	NO. SEC.	NATURAL GAS			LP - GAS			FLUE DIA. (Inches)	DIMENSIONS (Inches)					
		AGA Input *MBH	‡Heating Capacity *MBH	Net I = B = R Rating *MBH	AGA Input *MBH	‡Heating Capacity *MBH	Net I = B = R Rating *MBH		C			A	B	
									C	A	B			
DG-38	2	37.5	31	27				3	7½	38				
DG-75	3	75.0	60	52	70	56	49	5	10¾	44¾				
DG-112	4	112.5	89	77	105	83	72	6	14	57%				
DG-150	5	150.0	118	103	140	110	96	6	17¼	57%				
DG-187	6	187.5	146	127	175	137	119	7	20½	58¾				
DG-225	7	225.0	175	152	210	164	143	7	23¾	58¾				
DG-262	8	262.5	204	177	245	191	166	8	27	59				
DG-300	9	299.0	232	202	280	218	190	8	30¼	67				

* MBH = 1,000 BTU per hour. BTU = British Thermal Unit.

† For altitudes above 2,000 ft. ratings should be reduced at the rate of 4% for each 1,000 ft. above sea level

‡ Heating Capacity is based on D.O.E. (Department of Energy) test procedure.

CAPACITY OF PIPES - CU. FT. GAS PER HR.

FT. OF PIPE LENGTH	3/4"	1"	1 1/4"	1 1/2"
10	212	425	725	1170
20	150	300	510	810
30	122	252	425	670
40	105	218	370	580
50	95	195	330	520
75	77	160	270	420
100	66	134	232	365
150	55	110	190	300
	3/4" Ell or T Add 1.3 ft.			
	1 1/4" Ell or T add 2.6 ft.			
	1" Ell or T add 1.7 ft.			
	1 1/2" Ell or T add 3.3 ft.			

The Ratings marked "Net I=B=R Ratings" indicate the amount of equivalent direct cast iron radiation each boiler will take care of under normal conditions and thermostatic control. The Net I=B=R Ratings shown are based on an allowance of 1.15 in accordance with the factors shown on the I=B=R Standard as published by The Hydronics Institute.

Selection of boiler size should be based upon "Net I=B=R Rating" being equal to or greater than the calculated heat loss of the building.

The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements. Specifications and dimensions are subject to change without notice.

These boilers may be installed on combustible flooring when placed on Special Base No. 42135.

This boiler must not be installed on carpeting.

Before You Start

Check to be sure you have the right size boiler before starting the installation. See rating and capacity table on previous page. Also be sure the new boiler is for the type of gas you are using. Check the rating plate on the right side of the boiler.

You must see that the boiler is supplied with the correct type of gas, fresh air for combustion, and a suitable electrical supply. Also, the boiler must be connected to a suitable chimney and an adequate piping system. Finally, a thermostat (furnished), properly located, is needed for control of the heating system. If you have any doubts as to the various requirements, check with local authorities and obtain professional help where needed. Take the time to complete all of the steps for SAFE and PROPER operation of the heating system.

**KEEP BOILER AREA CLEAN AND FREE FROM COMBUSTIBLE MATERIALS,
GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS**

Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CSD-1.

The following steps are all necessary for proper installation and safe operation of your boiler.

1. LOCATING THE BOILER
2. FRESH AIR FOR COMBUSTION
3. SYSTEM PIPING
4. CHIMNEY & VENT PIPE CONNECTION
5. GAS SUPPLY PIPING
6. ELECTRICAL WIRING
7. CHECKING & ADJUSTING

Locating the Boiler

If your boiler is part of a planned heating system, locate it as nearly as possible where shown on your plan. If boiler is to be part of an existing system, it is usually best to put it where the old one was. If you plan to change location, you will need additional materials as well as an adequate base. The following rules apply:

1. The boiler must be level.
2. Use a raised base if floor can become wet or damp.
3. The vent pipe connection should be as short as possible.
4. Maintain clearances for fire safety as well as servicing. See Fig. 2 for minimum clearances.

Servicing clearances must take precedence over fire safety clearances.

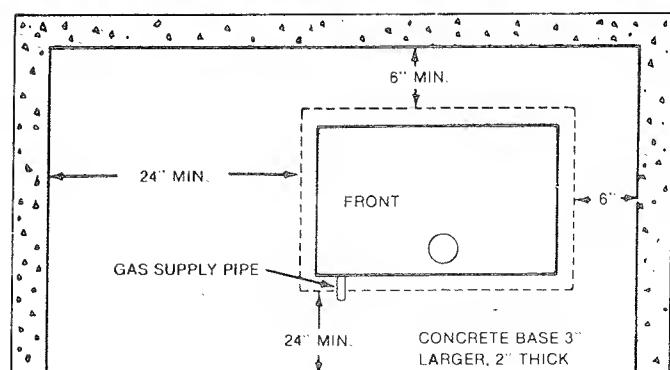
18" clearance must be maintained at a side where passage is required for access to another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Boilers must be installed at least 6" from combustible material on all sides. Allow at least 24" front and right side for servicing.

The room must have a total cubic foot volume not less than 16 times that of the boiler.

5. FRESH AIR for combustion must be available at the front of the boiler. FRESH AIR for ventilation must be available to the front AND rear of the boiler.
6. The floor supporting the boiler must be non-combustible. If it is combustible, place the boiler on 2" concrete patio blocks. The blocks must be under the entire boiler to protect the floor.

7. Be sure installation is in accordance with the requirements of the local utility or authorities having jurisdiction and "American Standard Installation of Gas Appliances and Gas Piping" ANSI Z223.1 1988. Compliance with these regulations is required.

FIG. 2 – MINIMUM CLEARANCE DIMENSIONS



THIS UNIT MUST BE SET ON A CONCRETE OR OTHER NON-COMBUSTIBLE MATERIAL BASE OR FLOOR. A CLEARANCE OF 56" MUST BE MAINTAINED FROM THE TOP OF THE UNIT TO COMBUSTIBLE CONSTRUCTION.

Fresh Air for Combustion

Provision for combustion and ventilation air must be in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-1988, or applicable provisions of the local building codes.

WARNING

Be sure to provide enough fresh air for combustion. Enough air insures proper combustion and **assures that no hazard will develop due to the lack of oxygen.**

You must provide for enough fresh air to assure proper combustion. The fire in the boiler uses oxygen. It must have a continuous supply. The air in a house contains only enough oxygen to supply the burner for a short time. Outside air must enter the house to replace that used by the burner. Study following examples 1 and 2 to determine your fresh air requirements.

EXAMPLE 1: Boiler Located in Unconfined Space

If your boiler is in an open area (unpartitioned basement) in a conventional house, the air that leaks through the cracks around doors and windows will usually be adequate to provide air for combustion. The doors should not fit tightly. Do not caulk the cracks around the windows.

An unconfined space is defined as a space whose volume is not less than 50 cubic feet per 1,000 Btu per hour of the total input rating of all appliances installed in that space.

EXAMPLE 2: Boiler Located in Confined Space

A. All Air from Inside the Building: The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure.

B. All Air from Outdoors: The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When directly communicating with the outdoors, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

NOTE

If you use a fireplace or a kitchen or bathroom exhaust fan, you should install an outside air intake. These devices will rob the boiler and water heater of combustion air.

2. When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.
3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of one square inch per 2,000 Btu per hour of total input rating of all equipment in the enclosure.
4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than three inches.

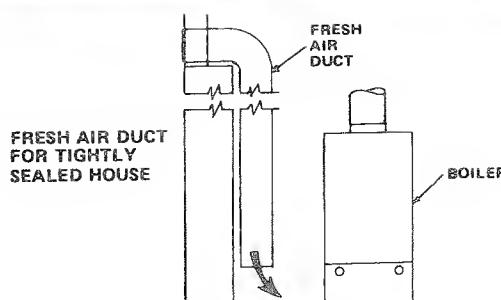
FIG. 3 - FRESH AIR DUCT CAPACITIES

Fresh Air Duct Capacities for Ducts Supplying Fresh Air to boiler in tightly constructed houses. British Thermal Units per hour Input (Btuh)*.

Fresh Air Duct Size	1/4" Mesh Screen Btuh	Wood Louvers Btuh	Metal Louvers Btuh
3" x 12"	144,000	36,000	108,000
8" x 8"	256,000	64,000	192,000
8" x 12"	384,000	96,000	288,000
8½" x 16"	512,000	128,000	384,000

*Based on opening covered by 1/4" mesh screen, wood louvers, or metal louvers.

FIG. 4
FRESH AIR DUCT FOR TIGHTLY SEALED HOUSE



Installation System Piping

1. Place boiler in the selected location (as near chimney as possible). Your boiler is shipped assembled. You need only to install the Relief Valve and a drain line to carry any water to a drain.
2. Install Relief Valve in tapped opening in the left end section. Connect a drain line of the same pipe size ($\frac{3}{4}$ ") to carry any water away to a drain.
3. Mount Draft Diverter on Draft Diverter Collar (Fig. 5 and 6) with two $\frac{1}{4}'' \times \frac{1}{2}''$ zinc plated screws. DO NOT CUT OR MAKE ANY CHANGES IN DRAFT DIVERTER.
4. Connect Supply and Return Lines to boiler. The connections may require certain additional fittings and parts, as shown on diagram (Figs. 5 and 6).

If you are replacing an old boiler with this new one, possibly all you will need do is to connect the existing piping to your boiler, and install the Relief Valve.

If you are installing an entire new heating system, first install all of your radiation units (panels, radiators or cabinets) and the Supply and Return Mains - then make the connections at the boiler.

In connecting the cold water supply to the water valve, make sure that a clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.

When boiler is used in connection with refrigeration systems it shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler (Fig. 7).

A hot water boiler installed above radiation level must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation.

When a low water cutoff is used, a periodic inspection and flushing of float types is necessary.

2" clearance must be kept between system piping and any combustible material.

FIG. 5 - FORCED HOT WATER TYPICAL PIPING

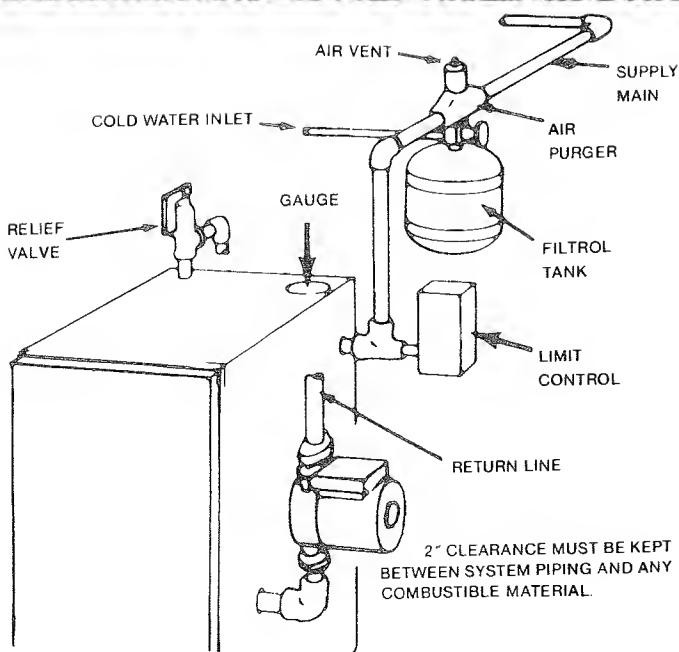


FIG. 6 - FORCED HOT WATER TYPICAL PIPING WITH ZONE CONTROL VALVES

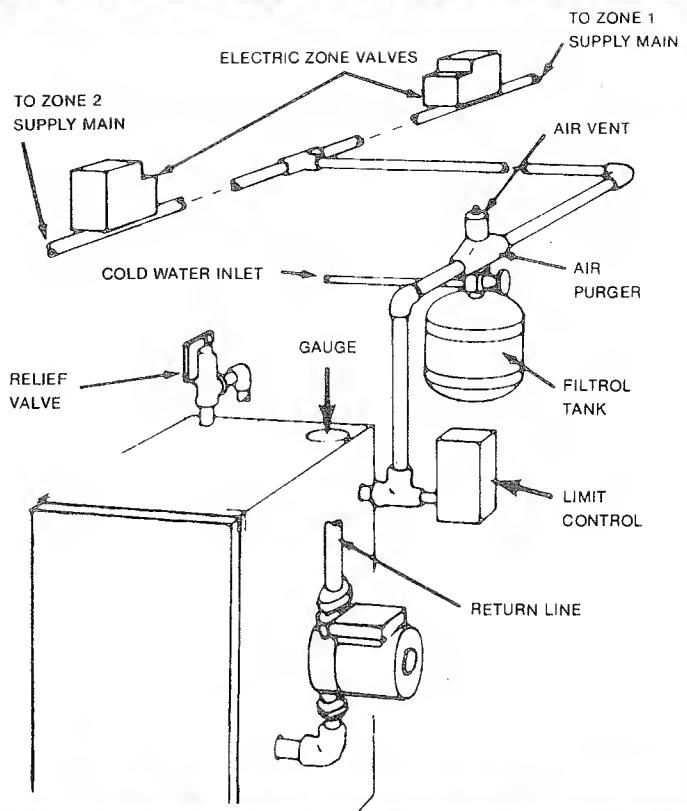
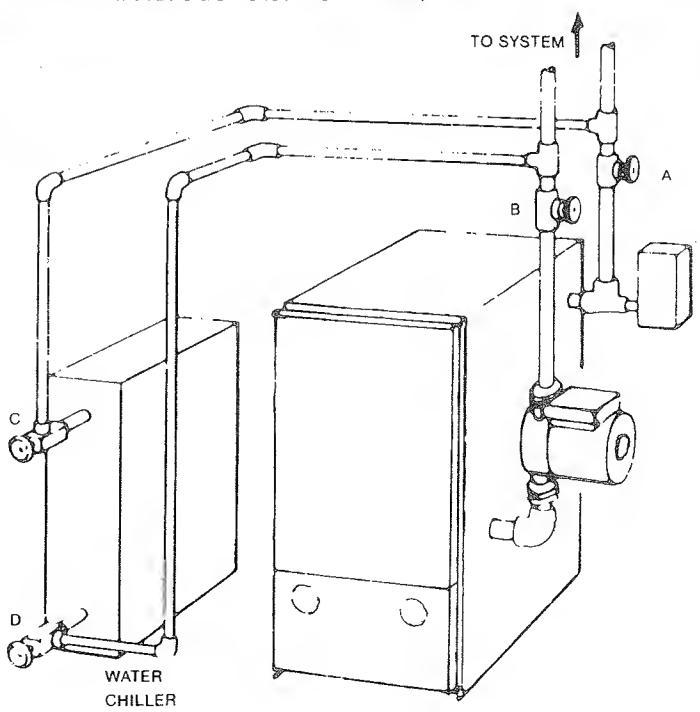


FIG. 7 - PIPING ARRANGEMENTS FOR BOILER WHEN USED IN CONNECTION WITH REFRIGERATION SYSTEM

VALVES A & B - OPEN FOR HEATING; CLOSE FOR COOLING
VALVES C & D - CLOSE FOR HEATING; OPEN FOR COOLING



Chimney and Vent Pipe Connection

CHECK YOUR CHIMNEY

This is a very important part of your heating system. It must be clean, the right size, properly constructed and in GOOD CONDITION. No boiler can function properly with a bad chimney. Fig. 8 gives minimum chimney sizes for boiler only. If your chimney is just big enough for your new boiler, it will not have extra capacity for other gas appliances. Fig. 9 gives you an idea how a boiler might be vented to a chimney. Note that the height (HT) is measured from the vent pipe to the top.

Vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code ANSI Z223.1-1988 or applicable provision of the local building codes.

Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Though a masonry chimney is shown, you may use an approved prefabricated chimney. If desired, we will make recommendations to you.

When two or more appliances are vented into the same chimney, the cross-sectional area inside the chimney must be at least equal to the area of the largest vent PLUS $\frac{1}{2}$ the area of each additional vent.

FOR EXAMPLE: Your boiler vent has a diameter of 5 inches (area 19.6 square inches). The water heater vent, a diameter of 4 inches (12.6 square inches). The minimum area of the chimney must be $19.6 + \frac{1}{2} \times 12.6$ or 25.9 square inches. This will require a 6" diameter round chimney.

CONNECTING THE VENT PIPE

WARNING - DO NOT install a vent damper in the vent pipe of this boiler.

1. Do not modify draft diverter furnished with boiler.
2. Vent pipe must be same size as outlet collar on draft diverter.
3. Slope pipe up from boiler to chimney not less than $\frac{1}{4}$ " per foot.
4. Run pipe as directly as possible with as few elbows as possible.
5. Do not connect to fireplace flue.
6. End of vent pipe must be flush with inside face of chimney flue. Use a sealed-in thimble for the chimney connection.
7. Horizontal run should not be longer than $\frac{3}{4}$ the chimney height (HT) (Fig. 9).
8. The sections of vent pipe should be fastened with sheet metal screws to make the piping rigid. Use stovepipe wires to support the pipe from above.

MINIMUM VENT PIPE CLEARANCE

If the vent pipe must go through a crawl space, double wall vent pipe should be used. Where vent pipe passes through a combustible wall or partition, use a ventilated metal thimble. The thimble should be 4 inches larger in diameter than the vent pipe.

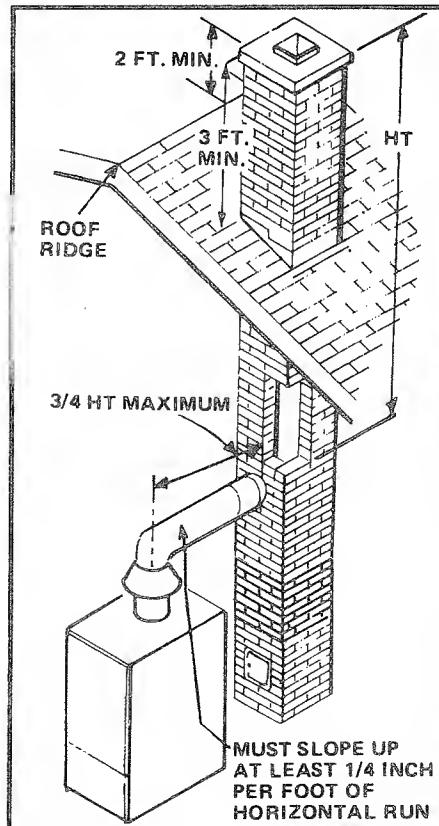
If boiler is installed with single wall galvanized-type vent, it must have a 6" clearance between its surface and any combustible material. If Underwriters Laboratories listed type B (insulated) vent pipe is used, clearance between it and combustible material must follow manufacturer recommendation.

FIG. 8 - MINIMUM CHIMNEY SIZES

Boiler Input Btu/h	Diameter Flue Pipe to Chimney	FLUE AREA IN INCHES		
		*HT. 10-15 Ft.	*HT. 15-25 Ft.	*HT. 25 Ft. Up
Up to 100,000	5"	6 x 6	6 x 5	5 x 5
Up to 155,000	6"	6 x 7	6 x 6	6 x 5
Up to 230,000	7"	7 x 8	7 x 7	6 x 7
Up to 350,000	8"	9 x 9	8 x 9	8 x 8

*HT = top of thimble to top of flue. See Fig. 9.
For boiler input refer to table, page 4.

FIG. 9 - CHIMNEY REQUIREMENTS



Gas Supply Piping

CHECK GAS SUPPLY

The gas pipe to your boiler should run direct from the gas meter (or propane regulator). It should supply only the boiler. It must be the correct size for the length of the run and your boiler rating. See Fig. 10 for the proper size. Be sure your gas line complies with local codes and gas company requirements.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of $\frac{1}{2}$ psig (3.5 kPa).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than $\frac{1}{2}$ psig (3.5 kPa).

CONNECTING THE GAS PIPING

Refer to Fig. 11 for the general layout at the boiler. It shows the basic fittings you will need. The gas line enters the boiler from the right side.

The following rules apply:

1. Use black iron piping and fittings.
2. All pipe compound must be resistant to liquified petroleum gas.
3. Install ground joint union in gas supply line between shutoff valve and boiler controls.
4. Install a sediment trap upstream of gas controls.
5. Use two pipe wrenches when making the connection to the gas valve to keep it from turning.
6. Install manual shut-off valve in vertical pipe about 5 feet above floor.
7. Tighten all joints securely.
8. LP - gas connections should only be made by a licensed propane installer.
9. Two-stage regulation should be used by the propane installer.
10. LP - gas piping should be checked out by the propane installer.

CHECKING THE GAS PIPING

Upon completion of piping, check right away for gas leaks. Open the manual shut-off valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak. CORRECT EVEN THE SMALLEST LEAK AT ONCE.

WARNING

Never use a match or open flame to test for leaks.

FIG. 10 - GAS PIPE SIZES

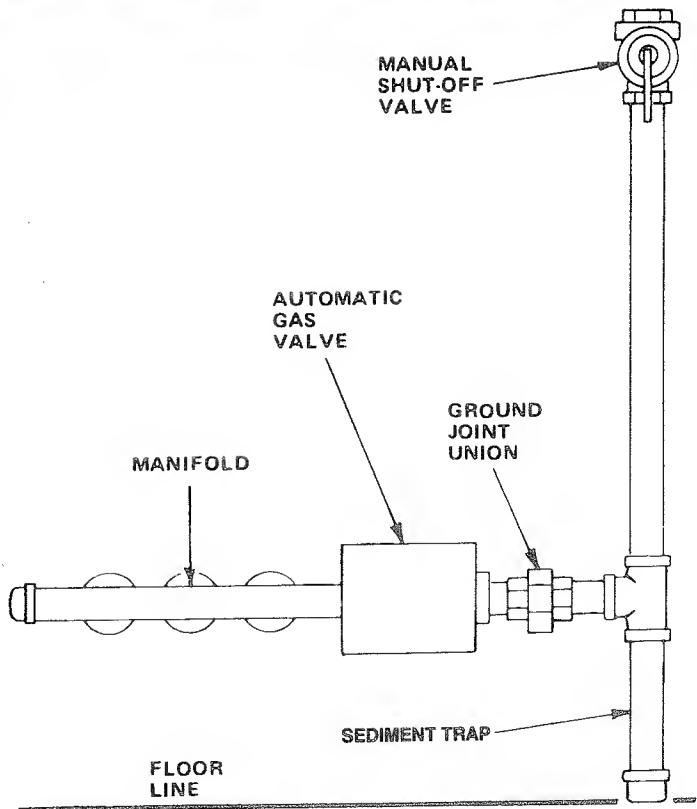
Length of Pipe - Ft.	NATURAL GAS			
	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	$1\frac{1}{4}$ "
20	92,000	190,000	350,000	625,000
40	63,000	130,000	245,000	445,000
60	50,000	105,000	195,000	365,000

Length of Pipe - Ft.	LP - GAS			
	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	Copper Tubing*	Iron Pipe		
20	131,000	216,000	189,000	393,000
40	90,000	145,000	129,000	267,000
60	72,000	121,000	103,000	217,000

*Outside diameter

The length of pipe or tubing should be measured from the gas meter or propane second stage regulator.

FIG. 11 - GAS PIPING AT BOILER



Electrical Wiring

INSTALLING YOUR THERMOSTAT

Locate the thermostat about five feet above the floor on an inside wall. It may be mounted directly on the wall or on a vertically mounted outlet box. It should be sensing average room temperature, so avoid the following:

DEAD SPOTS:

Behind doors
Corners and alcoves

HOT SPOTS:

Concealed pipes
Fireplace
TV sets
Radios
Lamps
Direct sunlight
Kitchens

COLD SPOTS:

Concealed pipes or ducts
Stairwells - drafts
Doors - Drafts
Unheated rooms on other side of wall

GROUNDING

If an external electrical source is utilized, the boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA No. 70-1987.

ELECTRIC POWER SUPPLY

WARNING

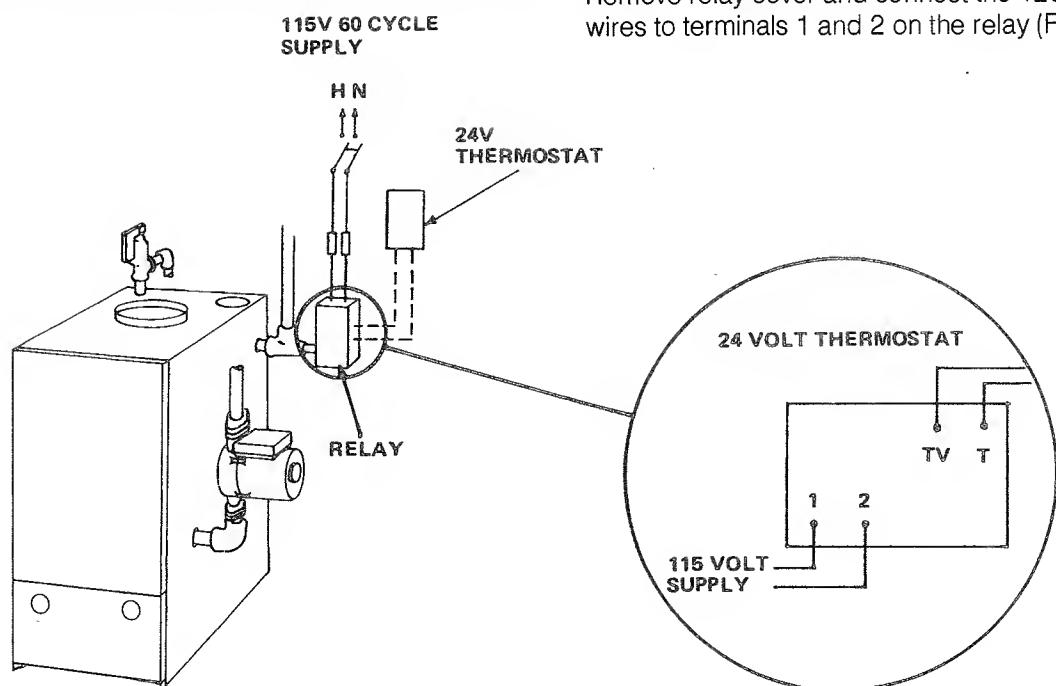
Turn off electric power at fuse box before making any line voltage connections. Follow local electrical codes.

All electrical work must conform to your local codes as well as the National Electrical Code. If you are not familiar with wiring and codes in general, have a competent electrician do this job.

The boiler controls are all wired at the factory. You need only connect a 120 volt electric supply and the thermostat wires to the relay on the right side of the boiler.

Run a separate circuit from a separate fuse in your electrical service entrance panel. This should be a 15 ampere circuit. Locate a shut-off switch at the boiler. It must be turned OFF during any maintenance.

FIG. 12 - CONNECTING WIRING



CONNECTING 120 VOLT WIRING TO BOILER

Remove relay cover and connect the 120 volt electric supply wires to terminals 1 and 2 on the relay (Fig. 12).

Equipment and Optional Accessories - What They Do

RELIEF VALVE

You must have a relief valve on your boiler. Water expands as it is heated. If there is no place for the water to expand into, water pressure will build up inside the boiler and system. Should this happen, the Relief Valve will automatically open at a pre-determined pressure. This will relieve the strain on the boiler and system. Run a pipe from the relief valve outlet (pipe must be same size as outlet and the open end must not be threaded) to an open drain, tub or sink, or other suitable drainage point not subject to freezing. Failure to do so may cause water damage or injury should relief valve release.

EXPANSION TANK

In a properly assembled system, the expanding water flows into an Expansion Tank. This tank should be of the correct size.

The tank is filled with air. As the water expands it compresses the air in the tank to form an air pressure cushion. This "spring-like" cushion serves to maintain correct operating water pressure regardless of water temperature. This assures a "full measure" of water, even in the highest radiation unit of the system. It also prevents blowing off of the relief valve.

The air in the tank in the beginning (with system filled with cold water) is sufficient for proper operation. The tank also serves as a trap for excess air in the system. The air would cause gurgling in the pipes and inefficient circulation in the radiators if left in the system.

It is possible for a tank to become "water-logged" (filled with water). It can also become overfilled with air. This can happen after filling the system with new water. Fittings provided on the tank and in the line to the tank are for bleeding off excess water or air.

When installing this tank, it is important: 1) That the tank be higher than the boiler top. 2) That the pipe to the tank continuously rises up to the tank (so that air can "bubble" up to it).

DIAPHRAGM TYPE EXPANSION TANK

The Diaphragm Type Expansion Tank (EX-TROL) takes the place of the conventional expansion tank. Carefully read the instructions packed with your EX-TROL Tank Assembly.

The EX-TROL Tank comes to you with a 10-12 pounds per square inch air charge. This is the same as the pressure produced in the system by the automatic fill valve. When the system is first filled, the EX-TROL Tank will contain little or no water.

As the water is heated its pressure increases. It expands into the EX-TROL Tank, compressing the air in the tank. This compressed air cushion permits the water in the system to expand as the temperature changes.

The Diaphragm Type Tank can be mounted on the Air Purger fitting or at any other convenient place in the supply or return line.

AIR ELIMINATING FITTING (AIR PURGER)

An Air Purger is used to remove excess air from the system. It is installed in the supply line. It will eliminate air from the water before it reaches the radiators and bleed off this air.

MAIN AIR VENT FOR DOWN FLOW SYSTEMS OR DIAPHRAGM TYPE EXPANSION TANK

Before a system is filled with water, there is air in the pipes and radiation units. Some of it will be trapped as the system is filled. It is possible to eliminate most of this air through the air vents on the radiation units. A Main Air vent will speed and simplify this. It should be installed on the highest point in the supply main when all radiation is below top of boiler.

AUTOMATIC FILL VALVE

For safe, efficient operation, a hot water system must be **filled** with water. Adding new water, when needed can be done manually (by use of a hand valve in the water supply line). This requires regular attention to the system's needs. An Automatic Fill Valve accomplishes this without attention. It is installed in the Supply Line on hot water boilers only. The Valve operates through water pressure differentials. It does not require an electrical connection.

DRAIN VALVE

This manual valve provides a means of draining all water from the boiler and system. It is often installed in the $\frac{3}{4}$ " tapping at the bottom of the front boiler section. Or it can be installed in a tee where the return line enters the boiler (Fig. 5, page 7).

WATER TEMPERATURE CONTROL

The water temperature limit control in the relay is adjustable and may be set as necessary. It may be set as low as 180° F, or as high as 240° F. This depends on the type and amount of radiation involved and weather conditions.

CIRCULATING PUMP

Every Forced Hot-Water System requires a Circulating Pump. A separate pump or zone valve is required for each Zone, if you have two or more Zone Systems. This pump must have the capacity to provide the circulation required by your system. The pump is connected into the Return Main just ahead of the boiler. It is also wired to the electrical system.

Starting Your Boiler

HOW A HOT-WATER SYSTEM OPERATES

Your entire heating system (boiler, piping and radiation units) is filled with water. As the water in the boiler is heated, it is pumped from the top of the boiler through the supply main to the radiation units. The cooler water in them flows back through the return main to the boiler. This provides positive and rapid response to the thermostat.

FILLING SYSTEM WITH WATER

Close the Air Vents on all radiation units. Open the Valves to these units. Make sure the boiler and Expansion Tank Drain Cocks are closed. The Air Bleed Screw on the tank Drain Fitting should be closed. Open the valve in the line from the boiler to the expansion tank (see page 15 for additional information). Open the water inlet to your boiler and leave it open. Start with the **lowest** radiation unit. Open the air vent on this unit. When all the air has escaped and water starts to flow from the vent, close it. Go to the next radiation unit, and repeat this process. Repeat until you have covered every radiation unit in the system (ending up at the highest unit in the system). If your units have automatic vents, this manual venting is unnecessary but it will speed up the proper filling of your system.

If your system is a closed expansion tank system, you may have an Automatic Fill Valve. You may leave it open to refill the system automatically as needed. Check the temperature-pressure gauge. Note the position of the hand indicating pressure. This should be between 10 and 15 lbs. Any lowering of this movable hand below 10 lbs. will indicate loss of water due to leakage. The automatic fill valve should compensate for this. Instructions are packaged with the valve.

FOR YOUR SAFETY READ THIS BEFORE OPERATING

1. This appliance has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.

WARNING: If you do not follow these instructions exactly, fire or explosion may result with property damage, personal injury, or loss of life.

2. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WARNING: IF YOU SMELL GAS:

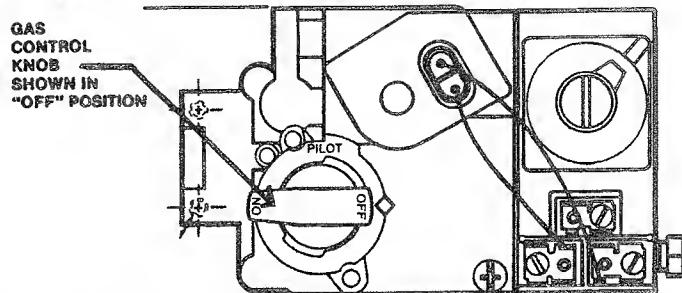
- Do not attempt to operate any appliance, do not touch any electrical switch, do not use the phone.
- Leave the building immediately and call your gas supplier.
- If your gas supplier cannot be reached, call the fire department.

3. **WARNING: When turning or depressing the gas control knob, use only your hand to push down or turn the knob. Never use tools. If the knob will not operate by hand, the control must be replaced by a qualified service technician. Force or attempted repair may result in a fire or explosion.**

4. **WARNING: If any part of this appliance has been under water, do not operate. Immediately call a qualified service technician to inspect the appliance and to replace any part of the gas control system which has been under water.**

OPERATING INSTRUCTIONS

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance.
3. Remove lower front panel.
4. Depress gas control knob slightly and turn clockwise to "OFF" position.



NOTE: Knob cannot be turned from "PILOT" to "OFF" unless knob is depressed slightly. Do not force.

6. **WARNING: Wait five (5) minutes to allow any gas in the combustion chamber to vent. If you then smell gas in the appliance area or near the floor, do not touch any electrical switch, do not use the phone. Leave the building immediately and call your gas supplier. If your gas supplier cannot be reached, call the fire department. Failure to do so may result in a fire or explosion. If you don't smell gas, go to next step.**

7. Find pilot - follow metal tube from gas control. The pilot is between the two burner tubes.
8. Turn gas control knob counterclockwise ↪ to "PILOT."
9. Push in control knob all the way and hold in. Immediately light the pilot with a match. Continue to hold the control knob in for about one (1) minute after the pilot is lit. Release knob and it will pop back up. Pilot should remain lit. If it goes out, repeat steps 5 through 10.
- If knob does not pop up when released, stop and immediately call your service technician or gas supplier.
- If the pilot will not stay lit after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.



10. Turn gas control knob counterclockwise ↪ to "ON."
11. Turn on all electric power to the appliance.
12. Set thermostat to desired setting.
13. After visually inspecting the flame, replace the lower front panel.

TO TURN OFF APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if servicing is to be performed.
3. Depress gas control knob slightly and turn clockwise to "OFF" position. Do not force.

AUTOMATIC GAS VALVE

The Automatic Gas Valve opens or closes according to the heat requirements of the thermostat and temperature limit control. It also closes if the pilot goes out. Each individual control must be operating correctly before any gas can pass to the burners. Any one control can hold the gas supply from the burner regardless of the demand of any other control. When the thermostat calls for heat, the gas valve opens and admits gas to the burner. When thermostat is satisfied, it opens the electrical circuit to the gas valve. The gas valve closes and stops the gas flow to the burner.

SAFETY PILOT

Safety Pilot prevents the flow of gas to burner if the pilot goes out.

SAFETY PILOT CHECK

With pilot lit and burners on, loosen thermocouple lead at automatic gas valve. As the lead is disconnected, both the main burner and pilot should go out. If one or the other remains lit, the gas valve is not functioning properly. Contact your local plumber or service technician. DO NOT RELIGHT THE PILOT. If both main burners and pilot go out, the valve test O.K. Reconnect thermocouple lead and light pilot. Tighten the lead finger-tight plus 1/4 turn with a wrench.

THERMOSTAT

Keep it set at a desired room temperature. If windows are to be opened or heat is not needed, turn thermostat pointer to a lower setting.

Checking and Adjusting

LIGHT PILOT BURNER

Light pilot using instructions in OPERATING INSTRUCTIONS (page 10). Leave thermostat at lowest setting.

ADJUST PILOT BURNER

Pilot flame should surround 3/8" to 1/2" of the thermocouple tip. Refer to Fig. 14 and 15. If flame needs adjusting, do it as follows:

1. Remove screw cover over pilot adjusting screw.
2. Insert small screwdriver and adjust flame as needed. Turn screw counterclockwise to increase flame, clockwise to decrease. (Fig. 13).
3. Turn thermostat to highest setting. Main burners should light quickly and smoothly. Turn thermostat to lowest setting. Main burners should go out. Pilot should remain lit.
4. Replace screw cover over pilot adjusting screw.

MAIN BURNER AIR ADJUSTMENT

The primary air shutters on the main burners should be adjusted so that flame forms a sharp blue cone with no yellow. Refer to Fig. 13.

ADJUST LIMIT CONTROLS

Instructions for each control are included with the controls.

RECOMMENDED BOILER WATER TEMPERATURES

Type of Heating Unit	Limit Control Setting
Standing Radiators	180° F.
Baseboard and Converter Radiators	200° F.

These settings can be changed after you have had some idea how the system works. Example: If your system does not give quite enough heat in very cold weather, you can raise the limit setting to 220° F. Use the boiler gauge to check your settings. Make the adjustments according to its readings.

FIG. 13 - LIGHTING PILOT

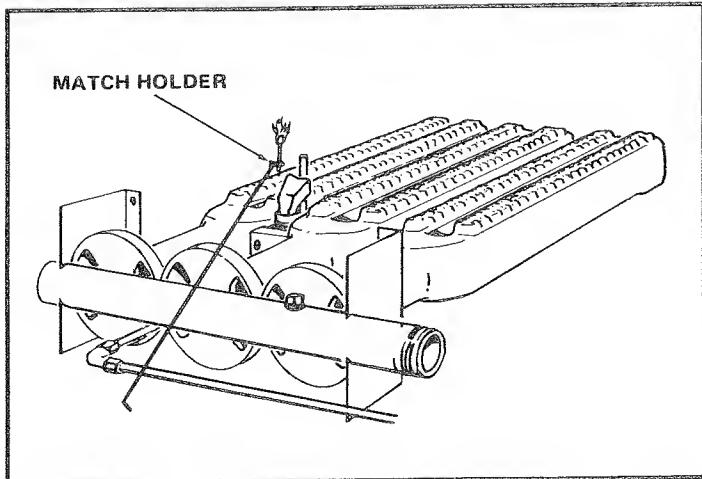
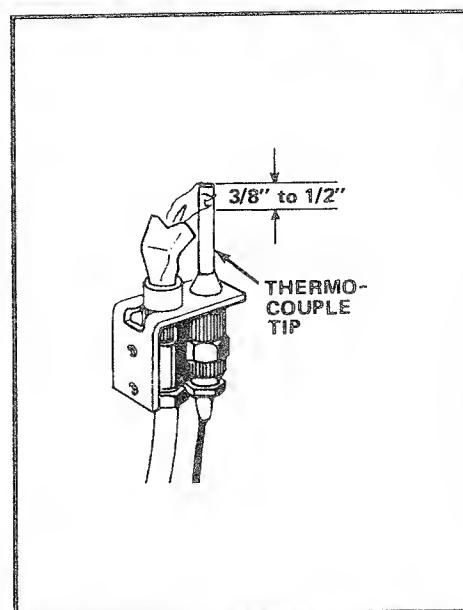


FIG. 14 - PILOT FLAME ADJUSTMENT



ADJUST THERMOSTAT HEAT ANTICIPATOR

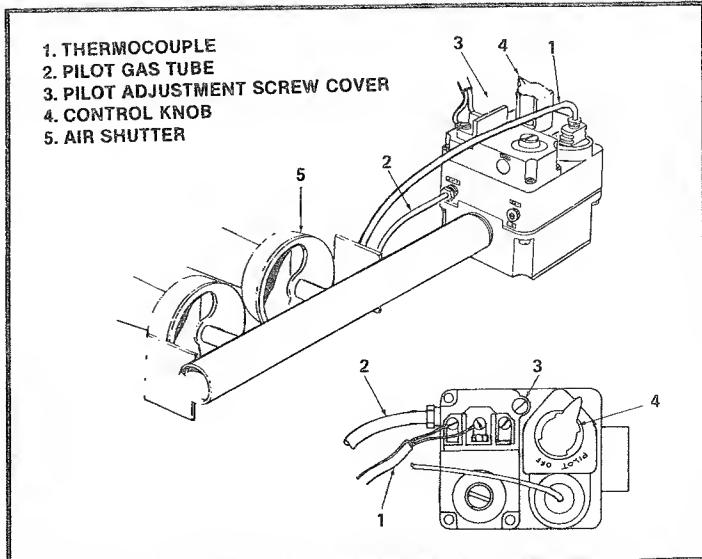
INSTRUCTIONS FOR THE FINAL ADJUSTMENT OF THE THERMOSTAT ARE PACKAGED WITH THE THERMOSTAT.

Set Heat Anticipator at .25.

Check thermostat operation. When set above temperature indicated on the thermometer, boiler burners should ignite. Make certain the thermostat turns off the boiler when room temperature reaches the selected setting and starts the boiler operating when room temperature falls a few degrees.

Finally, set the thermostat for the desired temperature. Special conditions in your home and the location of the thermostat will govern this setting.

FIG. 15 - AUTOMATIC GAS VALVE



System Checks After First Starting

These checks and adjustments pertain to the various controls and are to be made in accordance with instructions packaged with the controls.

Set the Thermostat for the desired room temperature. Next, adjust the Limit Control, which regulates the temperature of the water in the boiler. The temperatures listed in the table (pg. 11) have been found to be satisfactory for most installations. They can be varied if necessary, to suit the climate in which you live.

When the thermostat and limit control have been set, start the burner (page 10). Watch the Thermometer Gauge as the boiler warms up, and note the temperature at which it stabilized. If this temperature is not the same as the dial reading on the limit control, readjust the control to obtain the desired thermometer indication. (Any difference between

this gauge and the control gauge will be due to their different locations. Always use the thermometer gauge when adjusting the controls, for it is the more accurate of the two.)

After setting limit control to limit setting, check to see if it shuts off the gas supply to the burners. Turn your thermostat up to call for heat and let your boiler run until the temperature of the water reaches the limit setting. The gas valve should shut off and the circulator keep running until the thermostat is satisfied, or the water cools enough to restart the burners through the limit control.

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent tests specified in ANSI Z21.13 - 1987 Standard.

Maintaining Your Boiler

RELIEF VALVE

This valve should open automatically when the system pressure exceeds the safe limit (30 pounds per square inch). Should it ever fail to open under this condition, shut down your system. Drain it until pressure is reduced below the safe limit. Then have the valve replaced immediately.

EXPANSION TANK

As previously noted, this tank may become waterlogged, or may receive an excess of air. Frequent automatic opening of the relief valve indicates water logging. A high boiler temperature accompanied by unusually low radiation unit temperature (and "knocking") indicates excess air in tank.

To correct either condition, close the valve between the boiler and the tank. Drain the tank until it is empty. Check all the tank plugs and fittings. Tighten as necessary. Open the valve between the boiler and tank. Water will rise to the normal height in the tank if you have an automatic fill valve (otherwise, manually refill the system).

BOILER FLUE PASSAGES

Under normal operating conditions, with the burners properly adjusted, it should not be necessary to clean the boiler flue gas passages. However, to assure trouble-free operation, we recommend that you have the flue passages, burner adjustment, and operation of the controls checked **once each year** by a competent Service Technician.

Before the start of each season (or whenever system has been shut down for some time) recheck the whole system for leaks . . . and recheck the boiler and vent pipe for leaks.

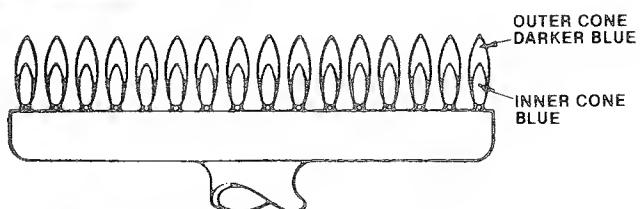
WATER SYSTEM

If system is to remain out of service during freezing weather, always **drain it** completely (water left in to freeze will crack the pipes and/or boiler).

CLEANING YOUR BOILER

Flue Passages between sections should be examined yearly and cleaned. Remove burners, venturi tubes and pilot. Remove vent pipe and draft diverter. Raise top panel of boiler and swing out to expose flue collector. Remove flue collector and clean out plate. Clean passageways between sections with a flexible handle wire brush. Remove dirt from the bottom of the boiler and reassemble all parts. Be sure to check tightness of pilot connections and adjustment of burner flames after reassembly. Be sure vent pipe connections to chimney are secure and no obstructions are present.

FIG. 16



THE MAIN BURNERS SHOULD BE ADJUSTED
SO THE FLAME FORMS A SHARP BLUE CONE
WITH NO YELLOW.

Service Hints

You may avoid inconvenience and service calls by checking these points before you call for service.

FOR YOUR SAFETY WHAT TO DO IF YOU SMELL GAS

1. Do Not try to light any appliance.
2. Do not touch any electric switch, do not use the phone.
3. Leave the building immediately, then call your gas supplier.
4. If you cannot reach the gas supplier, call the fire department.

IF YOUR SYSTEM IS NOT HEATING OR NOT GIVING ENOUGH HEAT . . .

Possible Cause	What to do
Thermostat is not set correctly	Reset thermostat above room temperature.
Burner is not operating properly	Check flame. If it is yellow, the burner is not getting enough air. Or, if flame is blue and noisy and seems to lift off the burner, the burner is getting too much air. Contact your service technician.
No electric power to boiler	Check fuse. If blown, replace. Check to be sure electric power supply circuit is "ON."
Controls out of adjustment	Reset according to instructions.
Radiators not heating	Open radiator vents to vent excess air. Check flow control valve (if used). It may be in closed position.
Circulating pump not running	Check fuse. If blown, replace. Check relay operation.
Poor electrical contact	Check all control terminals and wire joints.
Chimney flue is blocked	Pressure switch will not close and pilot spark will not operate to start pilot. Have your service technician check and correct, if necessary.

IF BURNER IS NOISY . . .

Possible Cause	What to do
Gas input amount is incorrect	Contact your service technician.

RELIEF VALVE LEAKING . . .

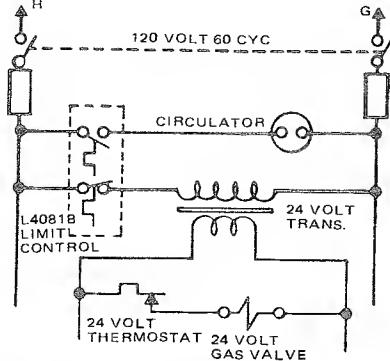
Possible Cause	What to do
Dirt on seat Water logged expansion tank	Open valve manually. Allow water to run and clear valve seat. Drain tank, see instructions.

HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.

24-Volt Wiring Diagrams

FIG. 17 - 24 VOLT HOT WATER BOILER WIRING

(Circulator Controlled by Water Temperature)



CODE OF WIRING

—	LOW VOLTAGE
—	HIGH VOLTAGE
— + —	WIRE CROSSOVER
▲	WIRE CONNECTION

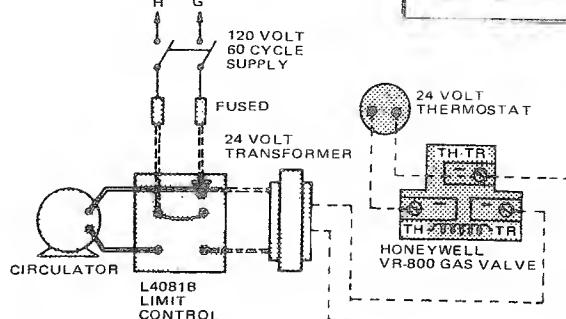


FIG. 18 - 24 VOLT HOT WATER BOILER WIRING

(Constant Circulation)

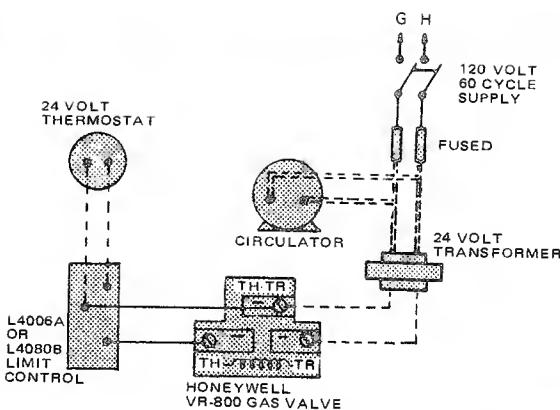
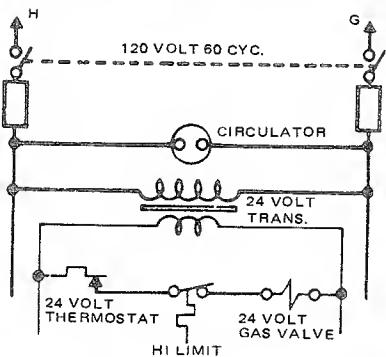
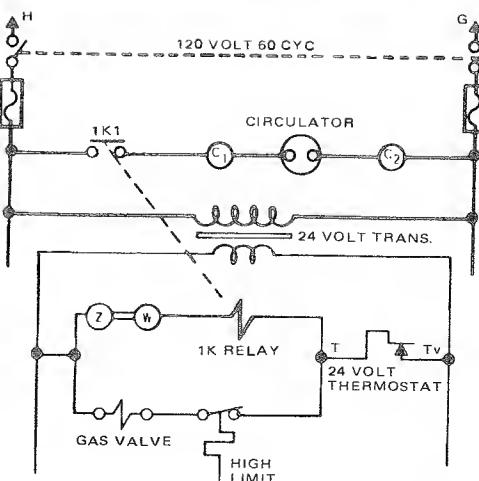
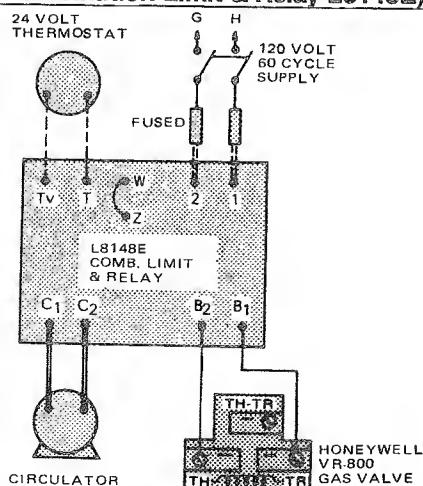


FIG. 19 - 24 VOLT HOT WATER BOILER WIRING

(Combination Limit & Relay L8148E)



IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED,
IT MUST BE REPLACED WITH THE SAME WIRE OR ITS EQUIVALENT.

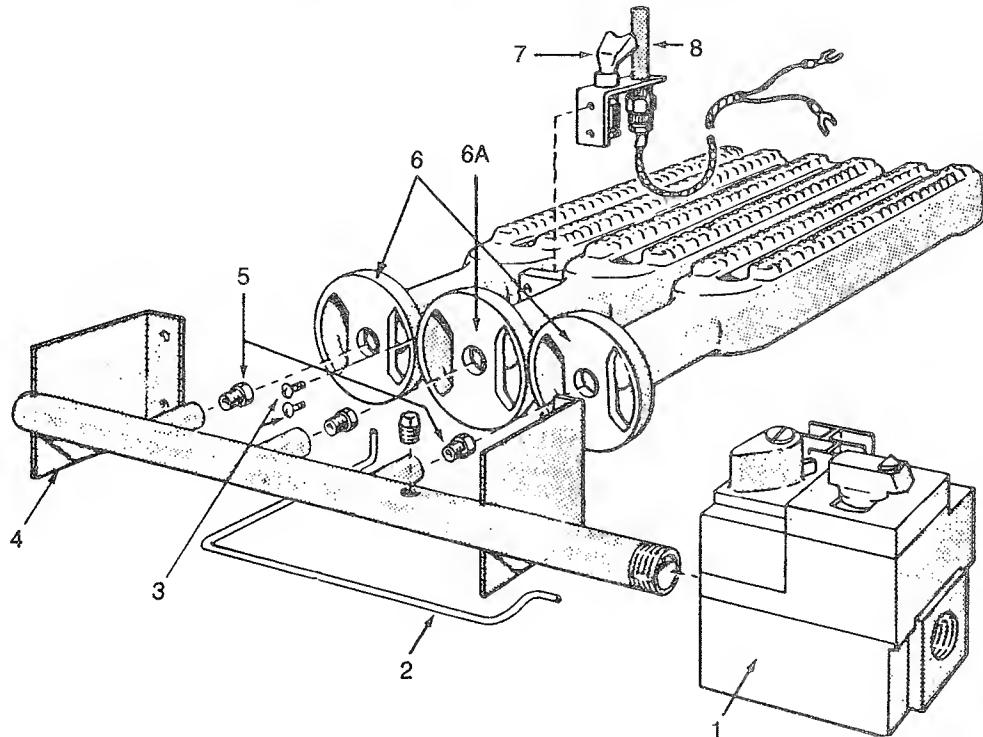
Repair Parts

IMPORTANT — READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier or direct from the factory.

When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part No. (not the Key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information: The Part No - The Part Description - The Boiler Model No.

FOR USE WITH NATURAL GAS ONLY



GAS BURNERS AND MANIFOLD PARTS

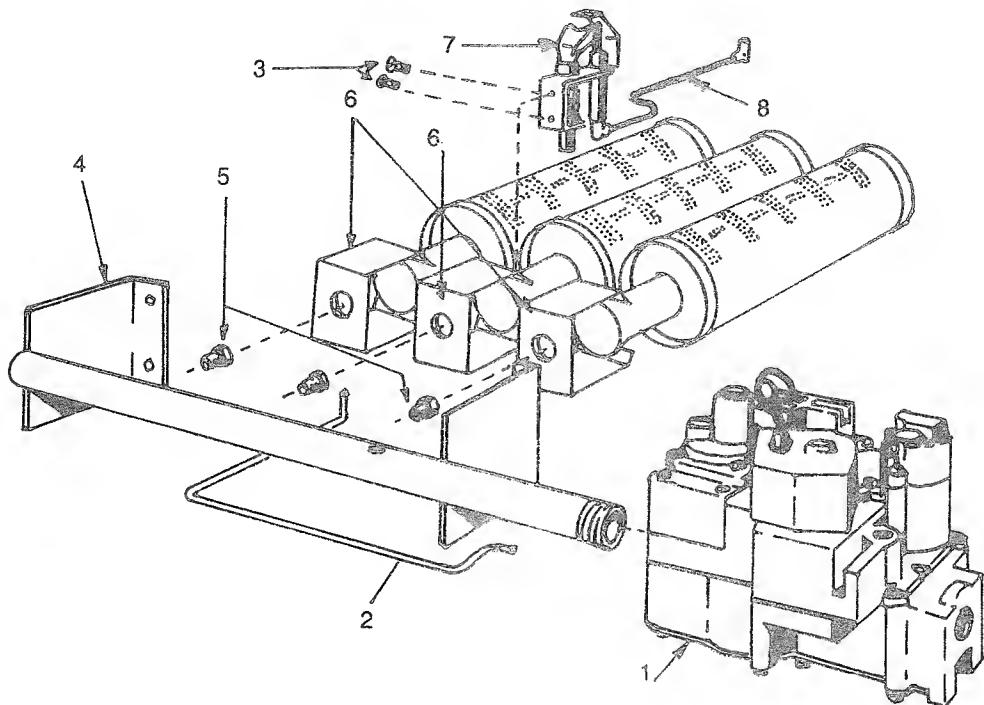
THIS IS A REPAIR PARTS LIST - NOT A PACKING LIST

KEY NO.	DESCRIPTION	NATURAL GAS							
		2 SECTION		3 SECTION		4 SECTION		5 SECTION	
		Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
1	24 Volt Gas Valve Natural Gas	19920	19920	19920	19920	146-62-064	146-62-064	146-62-064	146-62-064
2	Pilot Tube	433-00-956	433-00-956	433-00-957	433-00-957	433-00-909	433-00-909	433-00-909	433-00-909
3	10-32 Screw (2 required)	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307
4	Gas Manifold	146-16-009	146-16-010	146-16-011	146-16-012	146-16-013	146-16-014	146-16-015	146-16-016
5	Orifice - Natural Gas	146-15-035	146-15-035	146-15-035	146-15-035	146-15-035	146-15-035	146-15-035	146-15-035
6	Gas Burner, Regular	—	146-15-523	146-15-523	146-15-523	146-15-523	146-15-523	146-15-523	146-15-523
6A	Gas Burner, Regular w/Pilot Bracket	146-15-522	146-15-522	146-15-522	146-15-522	146-15-522	146-15-522	146-15-522	146-15-522
7	Pilot Burner with Orifice (Natural)	146-62-148	146-62-148	146-62-148	146-62-148	146-62-148	146-62-148	146-62-148	146-62-148
8	Thermocouple - 24 volt	146-62-037	146-62-037	146-62-039	146-62-039	146-62-039	146-62-039	146-62-036	146-62-036
‡	Air Shutter Springs	146-34-061	146-34-061	146-34-061	146-34-061	146-34-061	146-34-061	146-34-061	146-34-061
‡	Air Shutters	425-01-418	425-01-418	425-01-418	425-01-418	425-01-418	425-01-418	425-01-418	425-01-418

‡Not illustrated.

Repair Parts

FOR USE WITH LIQUEFIED PETROLEUM GAS ONLY



LIQUEFIED PETROLEUM GAS BURNERS AND MANIFOLD PARTS

THIS IS A REPAIR PARTS LIST - NOT A PACKING LIST

KEY NO.	DESCRIPTION	LIQUEFIED PETROLEUM GAS						
		3 SECTION	4 SECTION	5 SECTION	6 SECTION	7 SECTION	8 SECTION	9 SECTION
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
1	24 Volt Gas Valve for LP Gas	146-62-048	146-62-048	146-62-048	146-62-048	146-62-048	146-62-048	146-62-048
2	Pilot Tube	146-15-004	146-15-004	146-15-004	146-15-004	146-15-004	146-15-005	146-15-005
3	10-32 x 3/16" Hex Head Screw (2 Req'd.)	146-95-301	146-95-301	146-95-301	146-95-301	146-95-301	146-95-301	146-95-301
4	Gas Manifold	146-16-010	146-16-011	146-16-012	146-16-013	146-16-014	146-16-015	146-16-016
5	Main Burner Orifice*	146-15-036	146-15-036	146-15-036	146-15-036	146-15-036	146-15-036	146-15-036
6	Main Burner*	146-15-529	146-15-529	146-15-529	146-15-529	146-15-529	146-15-529	146-15-529
7	Pilot Burner	146-62-055	146-62-055	146-62-055	146-62-055	146-62-055	146-62-055	146-62-055
8	Thermocouple	146-62-037	146-62-039	146-62-039	146-62-039	146-62-039	146-62-036	146-62-036
‡	Rollout Shield	425-01-726	425-01-727	425-01-728	425-01-729	426-01-730	425-01-731	425-01-732
‡	Pilot Mounting Bracket	425-00-885	425-00-885	425-00-885	425-00-885	425-00-885	425-00-885	425-00-885

Quantity is 1 unless otherwise noted.

* Requires 1 less than the number of sections.

‡ Not illustrated.

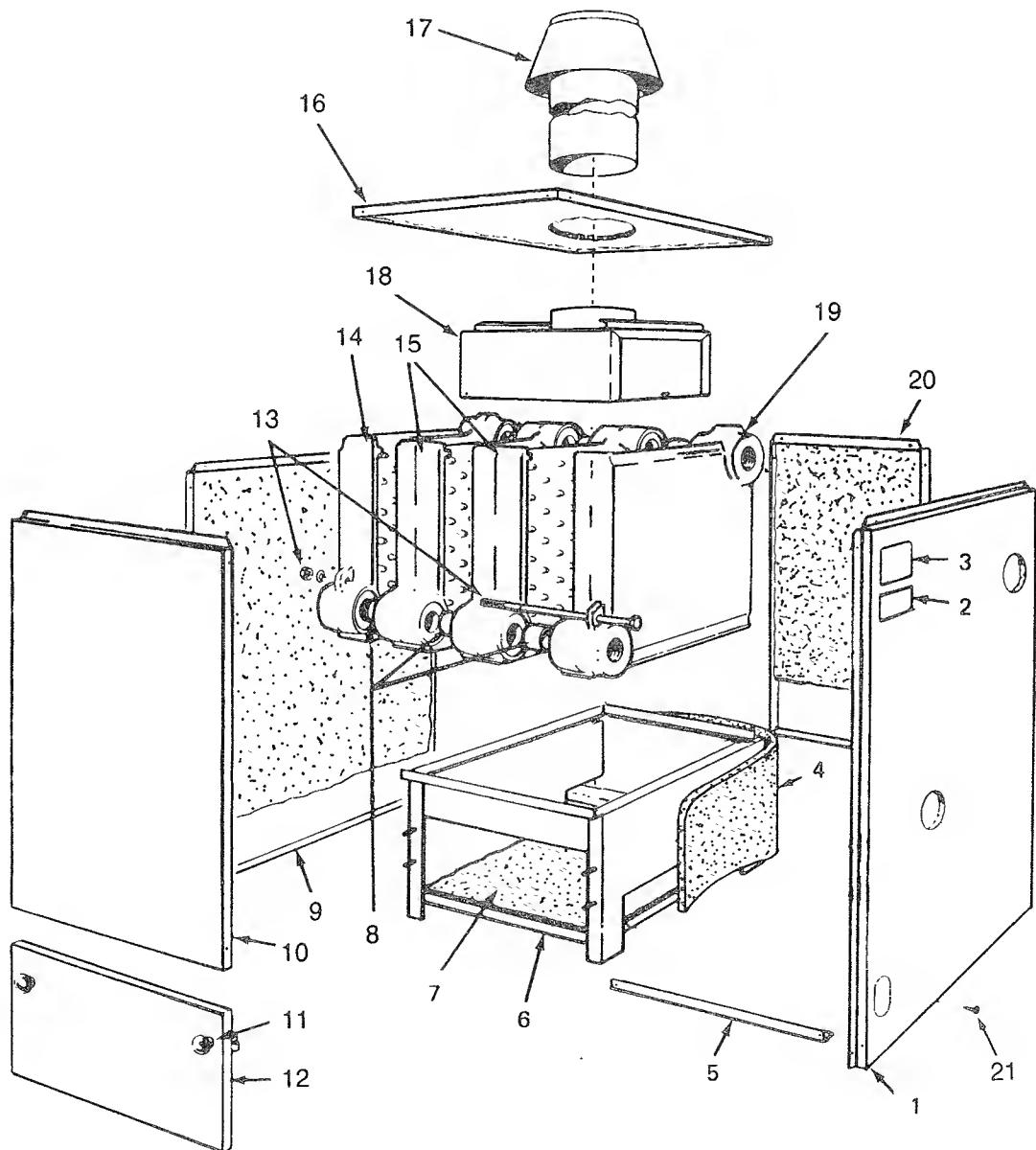
Repair Parts

IMPORTANT — READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier or direct from the factory. When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part No. (not the Key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information:

The Part No. — The Part Description — The Boiler Model No.

JACKET — SECTION AND BASE PARTS



FOR PARTS LIST SEE PAGE 19

GAS-FIRED HOT WATER BOILERS
 This is a Repair Parts List, NOT a Packing List
JACKET — SECTION AND BASE PARTS

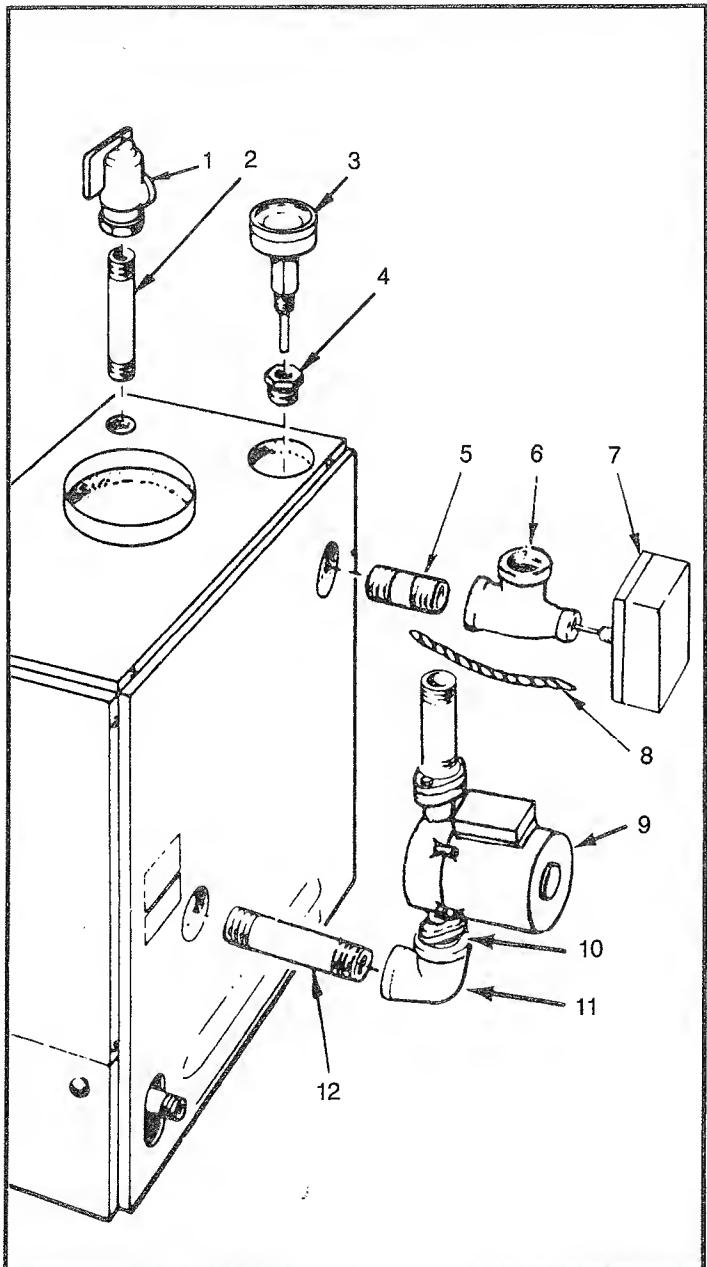
KEY NO.	DESCRIPTION	NATURAL GAS						
		2 Section Part No.	3 Section Part No.	4 Section Part No.	5 Section Part No.	6 Section Part No.	7 Section Part No.	8 Section Part No.
1	Jacket, Right Side Panel	425-01-471	425-01-471	425-01-471	425-01-471	425-01-471	425-01-471	425-01-471
2	Lighting Instruction Plate	146-00-000	146-00-000	146-00-000	146-00-000	146-00-000	146-00-000	146-00-000
3	Rating Plate Natural Gas	146-94-022	146-94-022	146-94-022	146-94-022	146-94-022	146-94-022	146-94-022
4	Insulation, Base Sides	433-01-826	433-01-827	433-01-828	433-01-829	433-01-830	433-01-831	433-01-832
5	Jacket Tie Bar	425-01-467	425-01-419	425-01-420	425-01-421	425-01-422	425-01-423	425-01-424
6	Boiler Base	425-01-772	425-01-757	425-01-758	425-01-759	425-01-760	425-01-761	425-01-762
7	Insulation, Base Pan	433-01-825	433-01-834	433-01-835	433-01-836	433-01-837	433-01-838	433-01-839
8	Nipple, Boiler	433-01-976	433-01-976	433-01-976	433-01-976	433-01-976	433-01-976	433-01-976
9	Jacket, Left Side Panel	425-01-473	425-01-473	425-01-473	425-01-473	425-01-473	425-01-473	425-01-473
10	Jacket, Front Panel	425-01-398	425-01-427	425-01-428	425-01-429	425-01-430	425-01-431	425-01-432
11	Knob, Jacket Access Door	137-02-103	137-02-103	137-02-103	137-02-103	137-02-103	137-02-103	137-02-103
12	Jacket Access Door	—	425-01-435	425-01-436	425-01-437	425-01-438	425-01-439	425-01-440
13	1/4" Tie Rod, Nut & Washer	146-05-008	146-05-001	146-05-002	146-05-051	146-05-053	146-05-005	146-05-007
14	Section, Left End	410-01-011	410-01-011	410-01-011	410-01-011	410-01-011	410-01-011	410-01-011
15	Section, Intermediate	410-01-010	410-01-010	410-01-010	410-01-010	410-01-010	410-01-010	410-01-010
16	Jacket, Top Panel	425-01-484	425-01-485	425-01-486	425-01-487	425-01-488	425-01-489	425-01-490
17	Draft Diverter	146-20-001	146-20-002	146-20-004	146-20-004	146-20-005	146-20-005	146-20-006
18	Flue Collector	425-01-749	425-01-750	425-01-751	425-01-752	425-01-753	425-01-754	425-01-755
19	Section, Right End	410-01-012	410-01-012	410-01-012	410-01-012	410-01-012	410-01-012	410-01-012
20	Jacket, Back Panel	425-01-474	425-01-475	425-01-476	425-01-477	425-01-478	425-01-479	425-01-480
#	Jacket, Complete	425-01-771	425-01-764	425-01-765	425-01-766	425-01-767	425-01-768	425-01-769
21	#10 x 1/2" Sheet Metal Screw	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074
#	5/16 x 1 1/4" Hex Hd. Screw	146-95-039	146-95-039	146-95-039	146-95-039	146-95-039	146-95-039	146-95-039
#	1/4"-20 x 1" Self Tapping Screws	146-95-054	146-95-054	146-95-054	146-95-054	146-95-054	146-95-054	146-95-054
#	Combustible Floor Plate	42135-1	42135-1	42135-1	42135-1	42135-2	42135-2	42135-2

Not illustrated.

For Parts Illustration, See Page 18

Repair Parts

GAS-FIRED HOT WATER BOILERS BOILER CONTROLS AND PIPING



KEY NO.	DESCRIPTION	PART NO.
1	3/4" ASME Relief Valve	146-22-011
2	3/4" x 5" Nipple	146-07-040
3	Temperature Pressure Gauge	146-23-003
4	3/4" x 1/4" Reducing Bushing	146-93-003
5	1 1/4" x 2 1/2" Nipple	146-07-044
6	1 1/4" x 3/4" x 1 1/4" Tee	146-93-049
7	High Limit Control L4006A	146-62-136
‡	Comb Hi Limit & Relay Control L8148E	146-62-024
8	BX Circulator Cable	433-01-904
9	Grundfos Circulator	146-26-045
10	1 1/4" Close Nipple	146-07-009
11	1 1/4" Ell	146-93-042
12	1 1/4" x 3 1/2" Nipple	146-07-008
‡	Drain Valve	146-22-001

‡ Not Illustrated